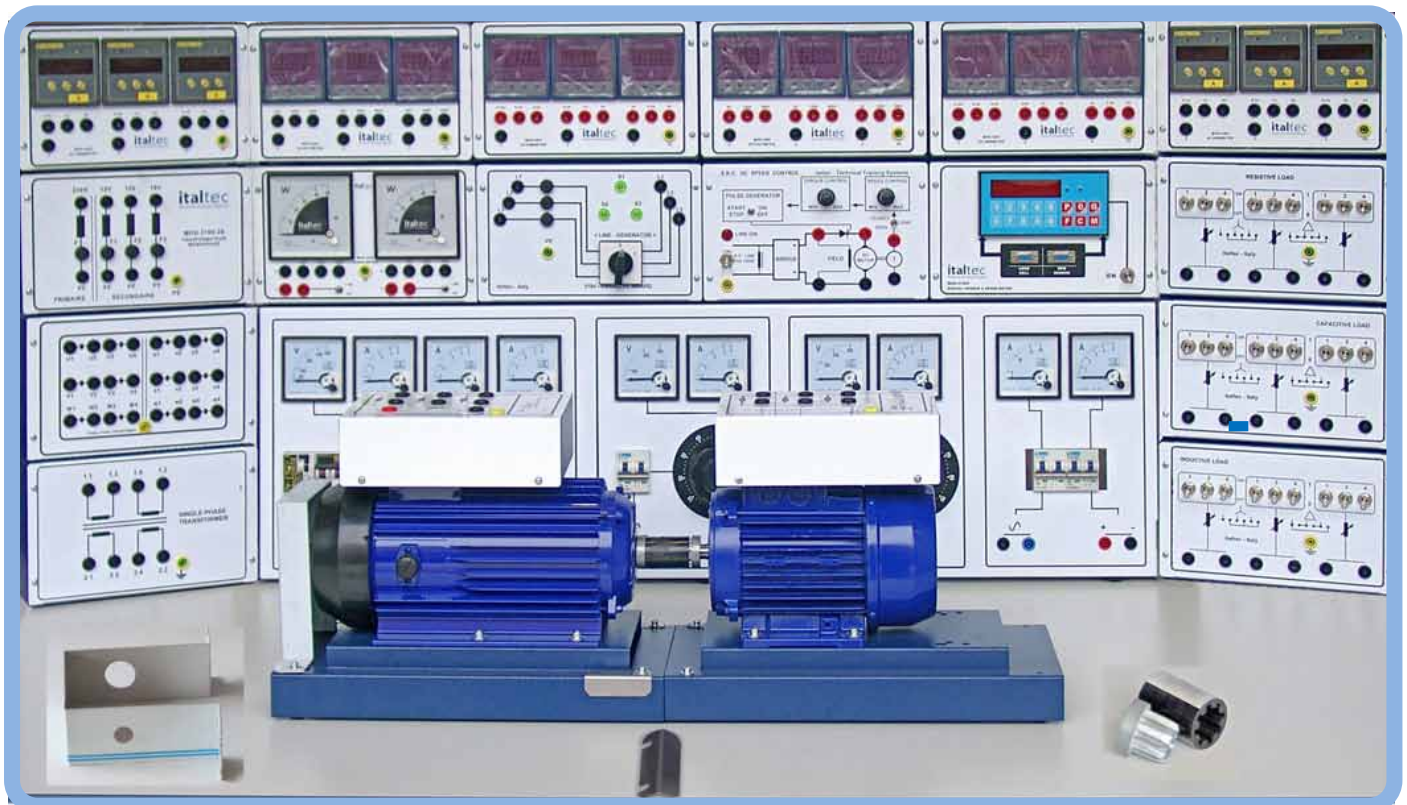


# italtec

Technical Training Systems

## EMMS Electrical Machine Modular System



**All EMMS versions:**

- 300watts = EMMS3 MOD.3XXX
- 1.000watts = EMMS4 MOD.4XXX
- 2.000watts = EMMS5 MOD.5XXX
- 3.000watts = EMMS6 MOD.6XXX
- 6.000watts = EMMS7 MOD.7XXX
- 8.000watts = EMMS8 MOD.8XXX
- 10.000watts = EMMS9 MOD.9XXX



## EMMS3

### ELECTRICAL MACHINES MODULAR SYSTEM 300W



## INDEX

1-EMMS -GENERAL DESCRIPTION .....	4
2-EMMS -EXPERIMENT MANUALS .....	5
3-POWER SUPPLY MODULE .....	6
4-D.C. MACHINES .....	7
5-A.C. MACHINES .....	8
A.C. MACHINES .....	9
A.C. MACHINES .....	10
6-TRANSFORMERS .....	11
7-BRAKES & TORQUE METERS .....	12
BRAKES & TORQUE METERS .....	13
8-STARTERS, VARIABLE LOADS .....	14
R.L.C. VARIABLE LOADS .....	15
9-MEASURE MODULES .....	16
MEASURE MODULES -POWER ANALYSER .....	17
MEASURE MODULES - ANALYSER SOFTWARE .....	18
10-AC/DC ELECTRICAL MACHINES KIT .....	19
11-SPEED CONTROL MODULES .....	20
12-ACCESSORIES .....	21
ACCESSORIES .....	22

## 1 -EMMS -GENERAL DESCRIPTION

### System Description

**italtec, has designed a new system for the application of electrical machines in experimental lessons.**

**This system is a complete and compact teaching mean, which can be accommodated on a standard 2 meter laboratory bench.**

**Thanks to its modularity, flexibility and compactness allows multiple stand-alone centers and to manage multiple combinations of the components that means more curricula, and in the same laboratory, with less overall spending.**

**The machines are industrial-type units in compliance with the construction type B3. The whole machines range meets the international standards DIN-VDE 0530.**

### Particular advantages of EMMS system are:

- Clearly arranged and swift set up of complete circuits;
- Safe operating by clear assignment of supply voltage and complete set of security devices:
  - no projections of rotating parts;
  - protection of all rotating parts;
  - low operation power, thereby minimising the risk of accidents;
  - standard 4 mm CE safety sockets for all inputs/outputs connections;
- very small space is required for use and for storage;
- power supply module provides also metering facilities and circuit protections;
- durability by the use of high grade materials;
- a step-by-step course of theory and experiments is described on each book included with each electrical machine;
- machines based on industrial standards, with all real features;
- all table top unit can be used in a frame system also;
- compatible with all other our programs;
- future-oriented thanks to the possibility to adapt to new technologies;
- optional overload protection with temperature sensor;

### EMMS consist of:

- universal power supply module used for all models of previous machines;
- set of motors, generators, transformers, brakes etc. which are the equipment for practical execution of experiments and measures;
- set of meter modules designed to cover the complete range of measurements with a small number of meters;
- set of resistive, inductive and capacitive loads housed in separate modules, and designed to provide balanced or unbalanced loads;
- set of accessories as:
  - connection leads;
  - tachometers;
  - dynamometers;
  - starting and excitation rheostat;
  - optional modules for electronic regulation of d.c. and a.c. motors;
  - optional computerised system for data acquisition and data management designed to plot curves and to store the complete test;

Each machine is equipped with its own universal support, which allows a very easy way to match all machines. EMMS's machines are the same machines normally used for industry applications.

Particular solutions has been used to simplify the student's approach and the system philosophy has been designed for educational purposes.



**Coupling sample**

Machines are available with 1500 rpm or 3000 rpm and different operative voltages as:

- main voltage (127/220V) 50-60Hz
- main voltage (240/415V) 50-60Hz
- main voltage (230/400V) 50-60Hz
- main voltage (24/48V) 50-60Hz



## 2 -EMMS -EXPERIMENT MANUALS

### D.C. Motors & Generators

- Connection and study of industrial type of d.c. machines operation, used as motors and generators;
- Operation with starter and field regulator;
- Reversing rotation and speed regulation;
- Measure of armature and excitation voltage and current;
- Speed and torque detection;
- Characteristic with variable R-load;
- Load characteristics with mechanical or magnetic brake;
- Adsorbed power, mechanical losses, iron losses, copper losses, efficiency;
- Comparison between shunt, series and compound connections;
- Shunt connection of two generators;
- Operation with electronic speed control;

### A.C. 3-phase Machines

- Operation with connection to power;
- Starting techniques: star-delta circuits, series resistance auto-transformer starter;
- Reversing rotation and speed adjustment;
- Measure of current and voltage values;
- Load characteristics (recording with an electromagnetic brake or magnetic powder brake or DC brake generator);
- Draw of circular diagram and its practical use;
- Real and reactive power, mechanical power;
- Power factor ( $\cos \phi$ ) efficiency and slip;
- Adsorbed power;
- Output power regulation;
- Shunt connection and synchronisation between two three-phase synchronous generators;
- Main synchronisation techniques;
- "V" characteristics: stability – limits;
- Operation as rotating capacitor / inductor;
- Three-phase shifter operation;
- Operation with electronic speed control;
- Fault finding:
  - Winding break in a coil;
  - Winding to winding short;
  - Coil to coil short;
  - Insulation fault.

### A.C. Single Phase Motors

- Operation with connection to power
- Starting techniques according to the machine type
- Reversing rotation and speed adjustment
- Influence of brush position on the speed;
- Measure of current and voltage values;
- Load characteristics (recording with an electromagnetic brake or magnetic powder brake).

### 1-PH / 3-PH Transformers

- Operation with connection to power
- Star-Delta, Zig-Zag and Scott connections
- Current and voltage measure at open circuit
- Current and voltage measure at full load and short circuit conditions;
- Shunt connection between two transformers;
- Load distribution.



The machines of this system are supplied with a proper base that allows an easy and safe coupling with other machines. It is easy to realise groups of machines.

Special didactic solutions have been introduced in order to simplify the approach of the student to the study.

### 3 -POWER SUPPLY MODULE



#### MOD.3000

##### Universal power supply

It is used for electrical supply of all EMMS machines, brakes and accessories.

Machines excitation voltage and magnetic brake supply are also included.

General protection with high sensitivity magneto thermal differential (0,03A) automatic circuit breaker, with analog or digital instruments.

Mushroom emergency push-button. Key-switch for output consent and ground terminal.

All outputs are protected by means of automatic magneto thermal circuit breaker.

• Power requirements: 400V, 3PH+N+G

#### OUTPUTS:

One universal single-phase safety socket 10/16A

3 phase adjustable output: 0-430V, 3A  
protection with magneto thermal automatic circuit breaker.  
- with 1 x A.C. voltmeter  
- with 3 x A.C. ammeters inserted on each phase

Single phase adjustable output: 0 -230V 3A  
protection with magneto thermal automatic circuit breaker.  
- with 1 x A.C. voltmeter  
- with 1 x A.C. ammeter

DC variable output: 0-220V, 3A

Protection with magneto thermal automatic circuit breaker.

- with 1 x D.C. voltmeter
- with 1 x D.C. ammeter

Single phase fixed output: - 230V A.C. 16A

Protection with magneto thermal automatic circuit breaker.

- with 1 x A.C. ammeter

D.C. fixed output: - 220V, 3A

Protection with magneto thermal automatic circuit breaker.

- with 1 x D.C. ammeter

#### All power supply (standard models):

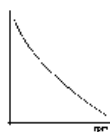
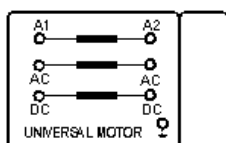
CODE	Three Phase Variable	Single Phase Variable	DC Variable	Single Phase Fix	DC Fix
MOD.0000	0-42V--10A	0-42V--10A	0-36V--2A	24V--10A	36V--4A
MOD.3000	0-430V--2A	0-230V--3A	0-220V--1A	230V--16A	220V--3A
MOD.4000	0-450V--3A	0-250V--4A	0-230V--1,3A	230V--16A	220V--7A
MOD.5000	0-450V--5A	0-250V--6A	0-230V--1,3A	230V--16A	220V--9A
MOD.6000	0-450V--9A	0-250V--9A	0-230V--1,3A	230V--20A	220V--15A
MOD.7000	0-450V--10A	0-250V--10A	0-230V--2A	230V--25A	220V--20A
MOD.8000	0-450V--15A	0-250V--15A	0-230V--5A	230V--30A	220V--30A
MOD.9000	0-450V--20A	0-250V--20A	0-230V--10A	230V--40A	220V--40A

**In addition to standard solutions, other desk can be realized on request.**

### 4 -D.C. MACHINES

#### Common characteristics for all electrical machines:

- Design: with typical industrial characteristics
- Complete with base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice
- Protection against thermal overload



#### MOD.3130E Universal Motor

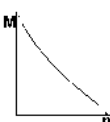
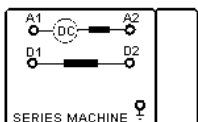
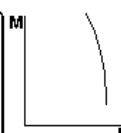
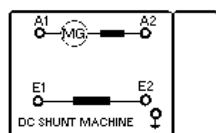
Modes: AC motor DC series motor

- Nominal voltage: 220V DC/AC
- Nominal speed: 3000rpm
- Nominal power: 0,3kW (DC) / 0,2kW (AC)

#### MOD.3140 Shunt Wound Machine

Modes: Motor, self- and externally excited generator;

- Nominal voltage: 220V
- Excitation voltage: 220V
- Nominal speed: 3000rpm
- Nominal power: 0,25Kw (mot) / 0,2kW(gen)



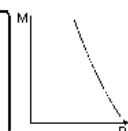
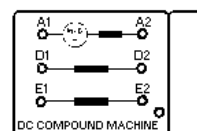
#### MOD.3150 Series Wound Machine

- Modes: series motor
- Nominal voltage: 220V
- Nominal speed: 3000rpm
- Nominal power: 0,2kW

#### MOD.3160 Compound Wound Machine

Modes: Motor, self-and externally excited generator.

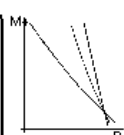
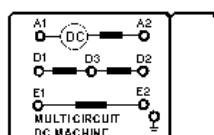
- Nominal voltage: 220V
- Excitation voltage: 220V
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(mot)/0,2kW(gen)



#### MOD.3165 Multi circuit Wound Machine

Modes: Shunt wound motor/generator, series wound motor, compound wound motor/generator.

- Nominal voltage: 220V
- Excitation voltage: 220V
- Nominal speed: 3000rpm
- Nominal power: 0,25kW (mot)/0,15kW (gen)



## 5.1 -A.C. MACHINES

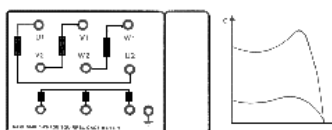
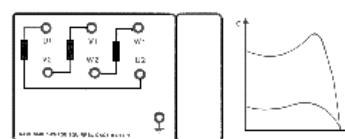
### Common characteristics for all electrical machines:

- Design: with typical industrial characteristics
- Complete with base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice
- Protection against thermal overload

### MOD.3040

#### 3-Phase Squirrel Cage Motor

- Nominal voltage: 220/380V, delta/star / 50Hz
- Nominal speed: 2800rpm
- Nominal power: 0,37kW
- $\cos\varphi=0,69$



### MOD.3050

#### 3-phase Slip Ring Asynchronous Motor

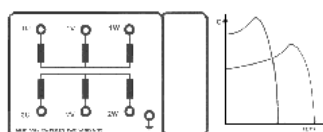
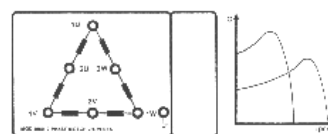
Cover for inspection of slip ring / brush area.

- Nominal voltage: 230/400V (delta/star)/ 50Hz
- Nominal speed: 2800rpm
- Nominal power: 0,2kW
- $\cos\varphi=0,82$

### MOD.3060

#### 3-Phase Dahlander Motor 2/4 Poles

- Nominal voltage: 400V (star-star) / 50Hz
- Nominal speed: 2800/1400 rpm
- Nominal power: 0,29/0,22kW
- $\cos\varphi=0,8/0,7$



### MOD.3065

#### 3-Phase motor 2/4 Poles

#### Two separate windings

- Nominal voltage: 400V (star/star) / 50Hz
- Nominal speed: 2800/1400rpm
- Nominal power: 0,6/0,4kW



### 5.2 -A.C. MACHINES

#### Common characteristics for all electrical machines:

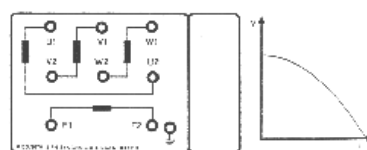
- Design: with typical industrial characteristics
- Complete with base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice
- Protection against thermal overload

#### MOD.3070

##### Three Phase salient poles Synchronous Generator

Modes: motor, generator.

- Nominal voltage: 220/380V/ 50Hz (delta/star)
- Excitation voltage: 200Vdc
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(gen)/0,2kW(mot)



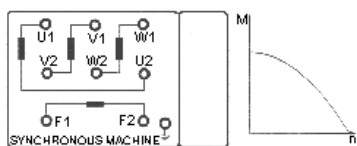
#### MOD.3074

##### Three Phase Synchronous Machine

Non-salient pole rotor.

Modes: motor, generator

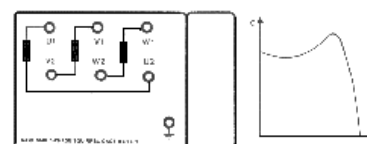
- Nominal voltage: 220/380V/ 50Hz (delta/star)
- Excitation voltage: 200Vdc
- Nominal speed: 3000rpm
- Nominal power: 0,25kW(gen)/0,2kW(mot)



#### MOD.3080

##### 3-phase Reluctance Motor

- Nominal voltage: 220V/380V (delta/star)/ 50Hz
- Nominal speed: 3000rpm
- Nominal power: 0,2kW
- $\cos\phi=0,6$

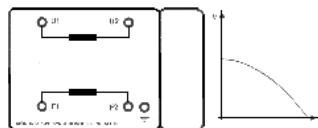


#### MOD.3072

##### Single Phase Synchronous Generator

Non-salient pole rotor.

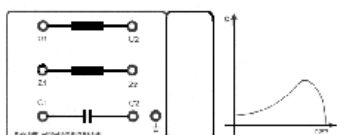
- Nominal voltage: 230V
- Excitation voltage: 200V DC
- Nominal power: 0,25 kW
- Speed: 3000rpm



#### MOD.3090

##### Single Phase a.c. Capacitor Run Motor

- Nominal voltage: 230Vac/50Hz
- Speed: 2800rpm
- Nominal power: 0,37kW
- $\cos\phi=0,94$



## 5.3 -A.C. MACHINES

### Common characteristics for all electrical machines:

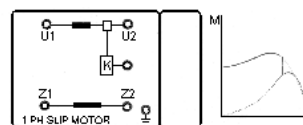
- Design: with typical industrial characteristics
- Complete with base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice
- Protection against thermal overload

#### MOD.3095

##### Split phase motor 2P 220V

Single-phase motor with starting auxiliary phase, complete with release relays.

- Nominal voltage: 230V AC 1PH /50Hz
- Speed: 2800 rpm
- Nominal power: 0,25kW
- $\cos\phi=0,92$

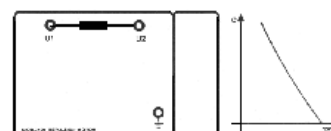


#### MOD.3100

##### Single Phase Repulsion Motor

Cover for inspection of collector / brush area. Motor with infinitely variable speed in both directions.

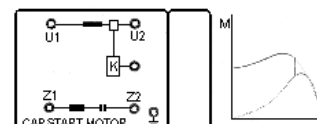
- Nominal voltage: 230V single-phase, 50Hz
- Nominal speed: 3000-0-3000 rpm
- Nominal power: 0,2kW
- $\cos\phi=0,88$



#### MOD.3120

##### Single Phase a.c. Capacitor Start Motor

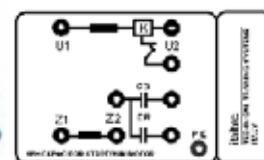
- Nominal voltage: 230V AC / 50Hz
- Speed: 2800 rpm
- Nominal power: 0,3 Kw
- $\cos\phi=0,94$
- Starting capacitor



#### MOD.3122 Single Phase a.c. Capacitor Start/Capacitor Run Motor

Complete with starting relay.

- Nominal voltage: 230V AC single-phase/ 50Hz
- Speed: 2800 rpm
- Nominal power: 0,24 Kw
- $\cos\phi=0,94$
- Starting capacitor and run capacitor

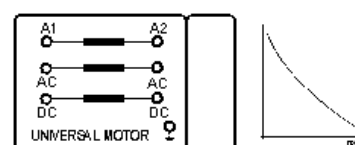


#### MOD.3130E

##### Universal Motor

Cover for inspection of collector-brush area. Modes: AC motor/ DC series motor.

- Nominal voltage: 220V DC/AC
- Nominal speed: 3000rpm
- Nominal power: 0,3Kw (DC) / 0,2kW (AC)



## 6 -TRANSFORMERS

### MOD.3190

#### Single Phase Transformer

Primary and secondary windings are divided in several sections to allow many connection possibilities.

- 230/110V primary/secondary.
- Primary: 2x115V Ac
- Secondary: 2x55V Ac
- Power: 300VA
- Frequency: 50/60 Hz



### MOD.3195

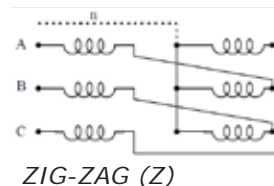
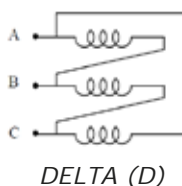
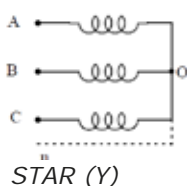
#### Three-phase Transformer

Primary and secondary windings are divided in several sections to allow many connection possibilities.

- Primary: 3x400 (3 x 2 x 115V)
- Secondary: 3x230 (3 x 2 x 66,5V)
- Power: 300VA
- Frequency: 50/60Hz

#### Primary/secondary connection

- STAR - STAR Yy
- DELTA - STAR Dy
- DELTA - DELTA Dd
- STAR - Zig-zag Yz
- DELTA - Zig-zag Dz



#### Training topics covered:

- Complete and simplified equivalent circuits
- Measurement of the individual variables
- Transformation of current and voltage
- Measuring the rush current using an oscilloscope
- Measurement and calculation of the no-load values
- Measurement and calculation of the short-circuit values
- Measurements with a variable load R, L & C
- Determining the efficiency
- Evaluating the measured values
- Phase angle between primary and secondary windings and the effect of asymmetric loading in the circuit groups Yy, Yd, Yz, Dy

## 7.1 -BRAKES & TORQUE METERS

### Characteristics:

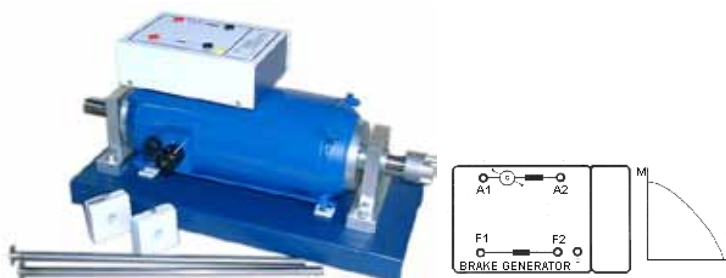
- Design: with typical industrial characteristics
- Complete with base plate and coupling cog for easy engagement with other machine
- Input/output with standard 4 mm safety sockets
- Imprinted terminal boards with the synoptic
- Two shaft ends on request
- Manual explaining theory and practice
- Protection against thermal overload

### MOD.3170

#### Shunt Excitation d.c. Generator

(brake generator)

- Nominal voltage: 220V d.c.
- Excitation voltage: 220V d.c.
- Power: 0,3 kW at 3000 rpm
- Complete with arms, weights and counterweights.



### MOD.3172

#### Inertia wheel

For simulating heavy starting and energy storage. Design: built into a machine housing with base plate.

- Flywheel mass: approx 5kg

### MOD. 3174

#### Magnetic powder brake

Magnetic powder brake as a mechanical load for torque detection of electric motors.

A slight excitation power is required and the full braking torque is available even at standstill. Torque recording is made using a load cell or a rotating torque-transducer.

Linked to the machine via a free shaft and with cog coupling sleeve and anti-vibration base plate. External cooling.

- Maximum torque: 25Nm



### MOD.3180

#### Electromagnetic Brake

Brake as a mechanical load for machines in the 0,4kW range. The brake is complete with arms, weights, counterweight, level indicator.

- Continuous rated braking: 300W at 3000rpm
- Discontinuous rated braking: 600W at 3000rpm.



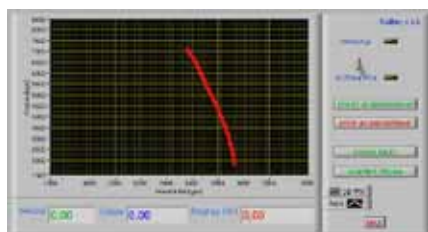
## 7.2 -BRAKES & TORQUE METERS

### MOD.3180C

#### Torque & Speed Meter with Load Cell

The meter is equipped with a load cell or a rotating torque transducer for torque detection and with speed sensor. When used with brakes, it allows to measure the motor torque and speed.

Both measurements are alternatively shown on the digital display, it can be calibrated both in kgm or Nm. A 0-10V analog output is provided for torque transmission. RS485 interface is included.



### MOD.3180CV-PC

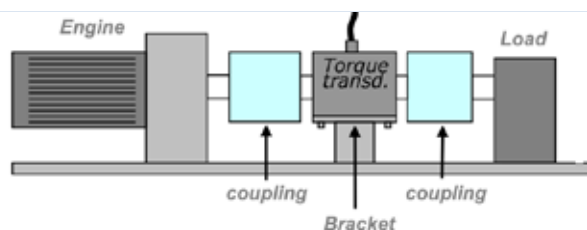
#### Torque & Speed Meter with management software

The meter is equipped with a speed sensor and a load-cell (or a rotating torque-transducer) for torque detection. When used with brakes, it allows to measure the motor torque and the speed. Both the values, alternatively, are shown on digital display, it can be calibrated in kgm or Nm.

Using this module, connected to the PC RS 232 port, it is possible to read on the PC screen: torque, speed and the instantaneous power, in real time while the motor is running. When a load is applied to the motor, it is possible to observe the increasing of torque and the decreasing of motor speed and get the power variation data.

From the PC it is possible to acquire all data and obtain the torque-speed graph for all machines under test.

Data are printable or it is possible to create and store them as a xls or pdf files.



The picture shows the schematic layout of the full system.

### MOD.3181

#### Electro dynamometer

This module allows a variable mechanical load for direct test on all machines of our system.

Electro dynamometer can be mechanically matched to all machines.

The torque direct reading in Nm or kgm is possible using torque meter MOD.3180C.



## 8.1 -STARTERS, VARIABLE LOADS

### Characteristics:

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets
- Manual explaining theory and practice



#### MOD.3010

##### Starter for Dc motor 0,1-0,3kW

- Resistance: 0-100%, linear  
Load carrying capacity: suitable for rpm setting of 50% at full torque
- Current: duty cycle 50%



#### MOD.3011

##### Starter rheostat for slip ring 3-phase motor 0,1-0,3kW

- Resistance: 3 x 0-100% linear continuously variable
- Current: Duty cycle: 50%



#### MOD.3012

##### Field regulator for a.c. and d.c. motors 0,1-0,3kW

- Resistance: 0-100% linear, continuously variable
- Current: duty cycle: 100%



#### MOD.3013

##### Field regulator for a.c. and d.c. generators 0,1/0,3kW

- Resistance: 0-100% linear, continuously variable
- Current: duty cycle: 100%



#### MOD.3016-R

##### Load resistor for 300W d.c. generators

- Resistance: 15% - 100% continuously variable
- Nominal power: 40W - 300W
- Protection against thermal overload



#### MOD.3018-R

##### Load resistor continuously variable 0,3 kW

- Resistance: 3 x 15% - 100% continuously variable
- Power: 40W to 300W
- Protection against thermal overload

## 8.2 -R.L.C. VARIABLE LOADS

### Characteristics:

- Practice and modular version table top
- Input/output with standard 4 mm safety sockets
- Manual explaining theory and practice



### MOD.3020-R Resistive Load Module 0,3kW

This module is fitted with 9 resistors in three identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently varied in 7 uniform steps from 0 to max current value for full power.

Single-phase connection provides 21 regulation steps.

- Power variation: 0-100%
- Duty cycle: 100%

### MOD.3020-L Inductive Load Module 0,3kVA

This is a module fitted with 9 inductors in three identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently changed in 7 uniform steps from 0 to max current value of full load.

Single-phase connection provides 21 regulation steps.

- Power variation: 0-100%
- Duty cycle: 100%



### MOD.3020-C Capacitive Load Module 0,3kVA

This is a module fitted with 9 capacitors in 3 identical groups to realise balanced or unbalanced 3-phase loads (star and delta) and single-phase loads.

Each phase can be independently changed in 7 uniform steps from 0 to max current value of full load.

Single-phase connection provides 21 regulation steps.

- Power variation: 0-100%
- Duty cycle: 100%



## 9.1 -MEASURE MODULES

### Characteristics:

- Input/output with standard 4 mm safety sockets
- Practice & compact table top module or for modular vertical frame unit
- User Manual included
- High precision and reliability



### MOD.3200VA

#### DC Voltmeter & Ammeter

- with four separate meters for Dc measurements
- DC voltmeters: 6 – 50 – 150 – 300V DC
- DC Ammeters: 100 - 500mA, 1 - 2,5A;



### MOD.3202AC

#### AC Ammeter Module

- with three separate ammeters for AC current measurement
- AC Ammeters: 0,5A - 1A - 2A



### MOD.3204AC

#### AC Voltmeter Module

- with three separate Ac voltmeter for voltage measurement
- DC voltmeter 50 – 250 - 500V



### MOD.3208

#### 3-Phase Power Meter

- Two power meters for measurements within 0-1000W.
- Max Voltage: 50-250-500V AC
- Max current: 1,5 - 3A



### MOD.3211 Frequency Meter Module

- Range: 45÷65Hz
- Voltage 0-500V AC



### MOD.3209B

- Three phase power-network analyser
- Input: 3 Voltage L-L & L-N; • Voltage range: 30÷400V
- 3 Current I1, I2, I3 ; • range 0,05÷5A
- Active, reactive, apparent power & total energy counters
- Frequency: 45÷65Hz • Power factor: +/-0,3
- Accuracy: 0,5%



## 9.2 -MEASURE MODULES -POWER ANALYSER

### MOD.3209-A

#### Power digital measuring unit

Connection: CE security terminals

Supply: 110÷230V AC 50/60Hz

Inputs:

- 3 for voltage 40÷600V AC
- 3 for current 0,05÷5A AC
- 1 for NEUTRAL line

It is possible to select different readings on the displays

Readings:

- Volt L1,L2,L3 for each phase,
- Volt LN for each phase, max 500V (optional up to 25 kV)
- Ampere for phase, max 5A (optional up to 10 kA)
- Active power, -Reactive power, -Apparent power,
- Active energy total resolution 0,1kWh, max 9999999,9 kWh
- Reactive energy total resolution 0,1kVarh, max 9999999,9 kVarh
- Frequency: 40÷ 100Hz
- Power factor PF up to +/- 1.00

Possible simultaneous readings:

- V-A x 3 phases + kVA or Hz or PF or kVar
- kWh + V-A x 2 phases + kVA or Hz or PF or kVar
- kWh + kVarh + V-A + kVA or Hz or PF or kVar

RS232, RS422/485 Serial communication opto-insulated line +1 set point relay or pulse for remote energy counter



2 relay: 1 set point relay & 1 energy remote counter relay or 2 energy remote counter relay 1kWh and 1 kVarh

Inputs ratio: Selectable from programming 1÷100 for VT (voltmetric transformer), 1÷4000 for CT (current transformer)

Programming: By 3 frontal switches for the primary secondary ratio both for CT (Current inputs) than for VT (voltage inputs).

Besides switches are used for programming relays, and for conversion for alternating reading to kWh and kVarh, and also for scanning of readings on the 7th display, for each reading its measure bright on the panel of the instrument.

- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top

### MOD.3209-C

#### Power digital measuring unit with graphic display

Supply voltages: 115 ÷ 230 - 400 V AC 50/60Hz

Inputs: for 3 or 4 wires line

Voltage : 40÷ 600V

AC Current: 0,05÷ 5A.

(Up to 1000A, 2500V with optional CT/VT)

Frequency: 30÷ 900Hz

READINGS:

Phase and System Voltage:

V-kV VL1-N, VL2-N, VL3-N, -ΣVL-N

Line Voltage:

V-kV, VL1-L2, VL2-L3, VL3-L1 -ΣVL-

Phase and System Current:

A-kA IL1, IL2, IL3, -ΣI

Phase and System Power Factor:

PFL1, PFL2, PFL3, -ΣPF

Phase and System Active Power:

W-kW-MW - PL1, PL2, PL3, -ΣP

Phase and System Reactive Power:

VAR-kVAR-MVAR - QL1 QL2, QL3, - ΣQ

Phase and System Apparent Power:

VA KVA - MVA - AL1, AL2, AL3, -ΣA

Frequency: Hz, FL1

Neutral Current: (On demand) A-kA IN

Active Energy Threephase: ΣkWh

Reactive Energy Threephase: ΣkVAh

It is possible to select different readings on the displays:

INSTANT MAXIMUM VALUES:

MAXIMUM MEDIA VALUES WITHIN 15'

MEDIUM VALUES WITHIN 15'



Using RS232 + management software it is possible create on PC screen the followings:

- 48 contemporary analogue and digital readings with Max and min values
- 48 contemporary barograph readings wit Max, min and alarms
- 72 channels for trend recorders
- 32 channels harmonics recorder
- 48 pages for FFT analyse
- K-Factor page
- 24 screen for waveforms monitoring
- Min & Max values
- Time Bands
- Counters page
- Energies pages
- 32 alarms status
- 8 digital outputs
- 8 digital inputs
- Power's sum table
- Temperature table
- Real time measure (contemporary showing of all 45 values)

- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top

## 9.3 -MEASURE MODULES - ANALYSER SOFTWARE

### THREE PHASE NETWORK ANALYSER'S SOFTWARE for 3209-A & 3209-C

Supervision and control software for PC data management with our three phase network analyser's and data acquisition systems.

Software is very impressive and extremely easy to operate.

Software is for Windows 7 and XP.

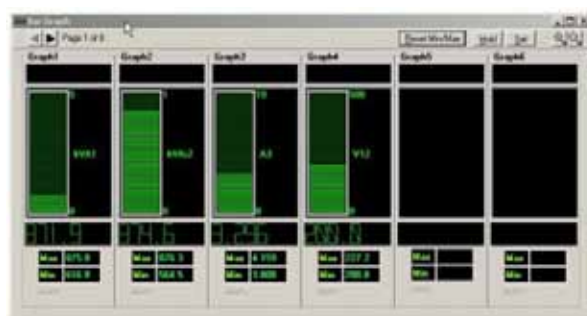
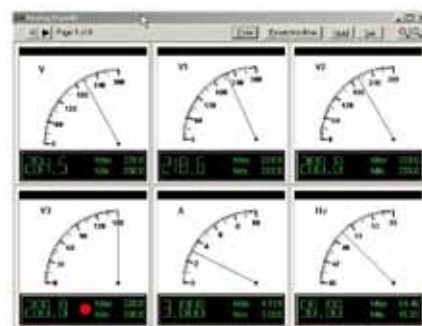
Possibility of management of setup of connected meters.

Complete programming, recording and alarm management.

Recording of Max and Min alarms and data logger event.

Showing of energy absorption in time bands.

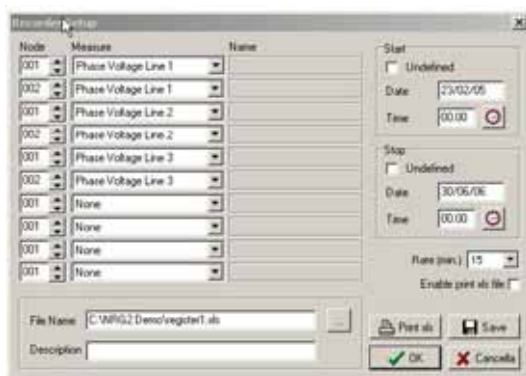
Digital and analogue showing (on analogue meters, digital meters and barograph) of all line parameters (voltage, current, frequency, power factor, active power, reactive power, apparent power, active energy, reactive energy positive and negative) with alarm set points.



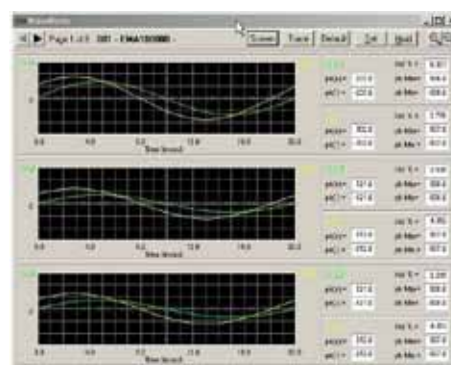
Digital and graphic harmonics visualisation of voltage and current up to 31.component (3209-C only)

Voltage			Current			TMD		
3Ph V	220.5 V		3Ph I	3.280 A		V1	0.066 T	
V1	220.5 V		I1	3.080 A		V2	2.352 T	
V2	220.5 V		I2	3.296 A		V3	3.612 T	
V3	220.5 V		I3	3.296 A		I1	3.214 T	
V1.0	217.7 V					I2	0.835 T	
V2.0	220.0 V					I3	9.037 T	
V3.0	212.4 V							
Active Power			Reactive Power			Apparent Power		
3Ph W	761.4 W		3Ph Q	473.0 Var		3Ph S	662.6 VA	
W1	752.4 W		Q1	628.9 Var		S1	585.5 VA	
W2	854.7 W		Q2	613.1 Var		S2	812.5 VA	
W3	853.3 W		Q3	661.6 Var		S3	817.2 VA	
Cosφ			Power Factor			Energies		
3Ph cosφ	0.893		3Ph PF	0.750		W1	2443.6 kWh	
cosφ1	0.893		PF1	0.750		W2	2425.3 kWh	
cosφ2	0.900		PF2	0.750		W3	3403.5 kWh	
cosφ3	0.900		PF3	0.750		W4	2464.3 kWh	
Average Power			Frequency					
W	766.7 W		Hz	50.00 Hz				
VA	3.800 VA							

Real time measure table with possibility of conversion on electronic page (Excel)



Signal recording



Waveform visualisation (3209-C ONLY)

**10 -SPEED CONTROL MODULES**

**MOD.3230**

**DC Speed Regulator Module**

This module allows the student to execute experiment on open and closed loop regulation on a Dc motors used as actuators in automation.

The module includes a current limiter with adjustable gain for the speed control and variable torque control.

- Operating voltage: 230V Ac
- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top



**MOD.3240**

**AC Speed Regulator Module**

This module allows the student to execute experiment on regulation of a.c. motors used as actuators in automation, robotics etc.

It includes a frequency converter with industrial characteristics with which execute all the common controls and regulations on a three-phase motor, generally used in industry.

- Operative voltages: 208/380/415V
- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top

**MOD.3182**

**Digital Precision Tachometer**

Digital Photo tachometer, for a safe and accurate RPM measuring both with and without contact with the motor shaft. It has a wide measuring range and high resolution. The last value, max. value and min. value will be automatically stored in memory and can be displayed by pressing a button.

- Test Range: 5 ~ 99999 RPM $\pm$ 0.05%
- Sampling Time: 1 sec. (over 60 RPM)
- Test range select: Automatic
- Memory: Last value, Max value, Min value
- Detecting Distance: 50~150mm/2~6 inch
- Max display/LCD size 99999 /18.5x48mm



**MOD.3185**

**Digital Speed Meter**

Multi-function tachometer to be used with an optical reflection sensor to visualise the electrical machine speed in a safe and accurate way without any contact with the machine shaft. It has wide measuring range and high resolution and includes a speed sensor.

- Analogue Output: 0-10V
- Internal resistance: 1Mohm
- Inputs/outputs: 4mm safety sockets
- Unit type: table-top unit

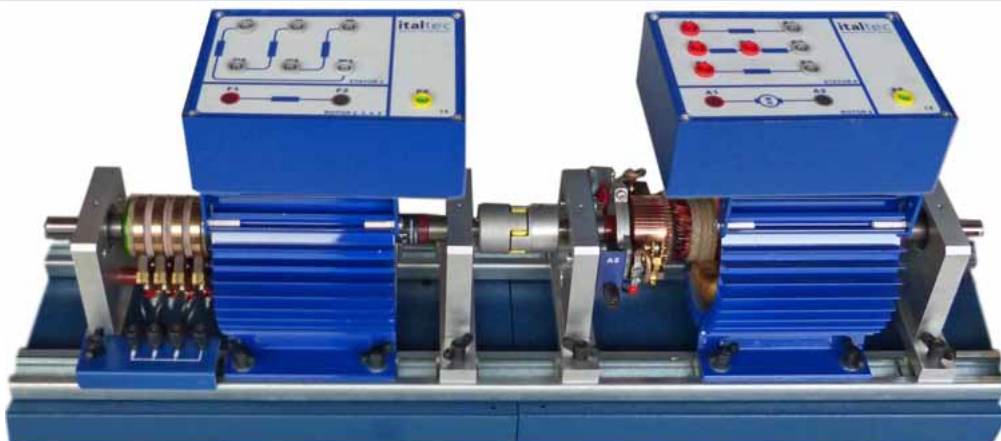


### 11 -AC/DC ELECTRICAL MACHINES KIT

#### Dissectible System Trainer Kit for Electrical Machines AC/DC

The system includes all the equipment required to perform the full range of student assignments. It provides a hands-on approach to the understanding of electrical machines principles. Designed for training technician and undergraduate engineers. The interconnection of the windings on to a didactic terminal box provides a visual understanding of the coil of the various electrical machines and their functions.

- Safety terminal connections



- Users are able to see the position of the brushes and their movement.
- Powered by 48 volt.
- Possibility for studying of different motors & generator

#### MOD.1002-AC

AC Machines:

- Single-phase motor with capacitors
- 2-pole star connection three-phase motor
- Star-delta three-phase asynchronous motor
- Three-phase slip-ring motor
- Synchronous three-phase motor
- Three-phase alternator
- ST2 Alternating current stator.
- RT2 Two Rings Winding Distributed Wound Rotor
- RT3 Two Salient-Pole Concentrated Rotor
- RT4 Two Pole Permanent Magnet Concentrated Rotor
- RT5 Slip ring rotor for functioning as motor & alternator.
- Three brushes for the slip-ring motor.
- One rotating brush holder.
- One brush holder mount.
- Half coupling.

- Base with rails for two machines.
- Two bearings for supporting the motor shaft.



- Power supply ca/cc; ca variable 0-50V 10A  
cc variable 0-60V 10A

#### MOD.1002-DC

- Base with rails for two machines.
- A direct current stator.
- Two bearings for supporting the motor shaft.
- DC shunt motor/ motor with commutating poles
- DC series motor/ motor with commutating poles
- Shunt compound generator
- Shunt compound generator with commutating poles
- Separately excited shunt motor

- Series generator with commutating poles.
- Separately excited series source rotor generator
- Separately excited series source stator generator
- Self-excited shunt compound generator
- An armature
- Half coupling.
- Power supply ca/cc; ca variable 0-50V 10A  
cc variable 0-60V 10A





### 12.1 -ACCESSORIES



#### MOD.3184 Synchronizing Module

This module includes three indicator lamps, three line fuses, a three polar switch and 6 security sockets. This module allows to see the synchronism between two 3-phase generators when are shunt connected between them or when a 3 phase generator is shunt connected to the main network.

- Operative voltage: 208/380/415V
- Input/Outputs: 4 mm CE safety sockets
- Unit type: Table top

#### MOD.3210 Tacho generator

Generator for r.p.m. detection, complete with base plate. In union with its rpm meter MOD.3210.C, it allows to read the motor speed.

Coupling type: cog coupling

- Output: 60mV/rpm
- Inputs/outputs: 4mm safety sockets
- Unit type: table-top unit



MOD.3210.C



#### MOD.3196 Connection Leads Set

This set consists of 30 leads in 3 different coded colours and lengths chosen to allow the realisation of all experiments provided in the manual.

Leads are capable of 32A current intensity and are terminated on banana-banana plugs.

#### MOD.3196M-50 Cable Holder.

#### MOD.3215 Gear block

Device for block the rotor of the three-phase asynchronous motor cage and slip ring.

- Coupling type: cog coupling
- Dimensions: LxWxH: 16 x 14 x 15cm
- Weight: 0,3kg



#### MOD.3212 Shaft end guard

- Dimensions: LxWxH: 3 x 9 x 11,5cm
- Weight: 0,094 kg



#### MOD.3213 Coupling guard

- Dimensions: LxWxH: 6 x 9 x 11,5cm
- Weight: 0,139 kg



#### MOD.3214 Rubber coupling sleeve

- Material: rubber
- Dimensions: 40x45 (length x diameter)
- Weight: 0,036kg



#### MOD.3214A Coupling gear



### 12.2 -ACCESSORIES

#### MOD.3302

Three-phase ON-OFF switch for direct start of 3ph induction squirrel cage motors with power up to 2kW.



#### MOD.3303

3 phase D.O.L. starter possibility to invert the rotation direction. It can be used up to 2,5kVA.



#### MOD.3304

Motor protective device three-phase. Adjustable current 1-1,6A



#### MOD.3305

Voltmeter switch L1-N, L2-N, L3-N, L1-L2, L1-L3, L2-L3



#### MOD.3308

Starting switch for three-phase motor with star-delta connection. It can be used up to 2,5kVA.



#### MOD.3310

Polarity reverser for 2 speeds 3 phase motors, "Dahlander" type up to 2,5kVA.



#### MOD.3311

Polarity switch for 2 speed motor with separate windings with star connection.



#### MOD.6030

Mobile bed for all electrical machines, with 4 wheels



#### MOD.6031

Mobile bed for all electrical machines and tabletop modules, with 4 wheels



#### MOD.6030B

Rail bed for all electrical machines, tabletop



#### MOD.3299

Table Top Vertical Frame



## A

[AC High Power Variable Transformers](#)  
[Voltage AC Variators](#)  
[Ammeter Clamp from 10 to 1300 A](#)  
[Ammeters for AC & DC](#)  
[Analog - Digital Servo](#)  
[Analogue & Digital Tachometers](#)  
[Antenna trainer \(A\)](#)  
[Antenna TRAINER \(B\)](#)  
[Analogue Multimeter](#)  
[Autotransformers](#)

## B

[Benches for electric motor assembly](#)  
[Brake Generators](#)  
[Bread Board](#)

## C

[Capacitor Box](#)  
[Capacitive Loads 0.1: 0.3:kVAr](#)  
[Capacitive Loads 1-2kVAr](#)  
[Capacitive Loads 3-5kVAr](#)  
[Capacitive Loads 0.1: 0.3: 1: 3: 5kVAr](#)  
[Central Zero Voltmeter](#)  
[Chemical Process Control pH](#)  
[Connecting Leads](#)  
[Copper for winding](#)  
[Current Transformer](#)

## D

[Data acquisition of electrical signals](#)  
[DC-AC Machine Regulator](#)  
[Decade Capacitor Box](#)  
[Decade Inductor Box](#)  
[Decade Resistor Box](#)  
[Digital-Analog Servo](#)  
[Dynamo](#)  
[Digital Power Meters](#)  
[Digital Phase Meter](#)  
[Digital Thermometer](#)

## E

[Electric Installations](#)  
[Electrodynamics Power Meters](#)  
[Electronic Power Meter](#)  
[Electrical Machines DC & AC](#)  
[Electrical Measure Benches](#)  
[Electrical Machine Test Benches](#)  
[Electromechanics Working Benches](#)  
[Electronic Power Meter](#)  
[Electronic - Laboratory Benches and Power Supply Desks](#)  
[Energy Meter 1-Phase](#)  
[Energy Meter 3-Phase](#)  
[Electrodynamics Voltmeters](#)  
[Electrodynamics Ammeters](#)  
[Electromagnetic Brakes](#)  
[Electric Plant Benches](#)

## F

[Flux and Level Control](#)  
[Frequencymeter \(digital\)](#)  
[Frequencymeter 44-66Hz](#)  
[Function Generators](#)  
[Function generator \(High Power\)](#)

## G

[Galvanometers for D.C.](#)  
[Electric Machine Groups](#)  
[Groups of Industrial Electric Machines](#)  
[Ground Terminals](#)  
[Ground Terminals CE](#)  
[Ground Meter](#)

## H

[High Power Variable Transformers](#)  
[Hydraulic Learning Systems](#)  
[High Insulation Probe](#)  
[Hydraulics](#)

## I

[Inductive Loads 0.1: 0.3:kVAr](#)  
[Inductive Loads 1-2kVAr](#)  
[Inductive Loads 3-5kVAr](#)  
[Inductor Box](#)  
[Insulation Meters](#)  
[Insulated Terminals](#)

## L

[Laboratory Ammeter Class 0.5](#)  
[Laboratory Furniture](#)  
[Laboratory Benches \(List\)](#)  
[Leads](#)  
[Logic Analyzer](#)  
[Logic Probe](#)  
[Luxmeter](#)

## K

[Kit for Practical Domestic Installations](#)  
[Kit for Practical Industrial Installations](#)  
[Kit for Domestic Installations](#)  
[Kit for Industrial Installations](#)  
[Kit for Alarm Installations](#)  
[Kit for Video Installations](#)  
[Kit for EIB Installations](#)  
[Kit for Assembly Electronic Apparatus](#)  
[Kit for basic electricity & electronics](#)  
[Kit for Electric Motors Assembly](#)  
[Kit for Transformer Assembly](#)

## M

[Mechanic, - CNC Lathe](#)  
[Mechanic, - CNC Mill](#)  
[Mechanic, - Robotics & Workcell](#)  
[Megahomometer](#)  
[Measure Instruments Class 0.5](#)  
[Measure Instruments \(Panel Type\)](#)  
[Microwave Systems](#)  
[Microstrip Systems](#)  
[Milling Machine CNC](#)  
[Motor Winding Machines and accessories](#)  
[Motor Winding Machines](#)  
[Mobile Iron Voltmeters Class 0.5](#)  
[Motor and Transformer test Benches](#)  
[Motor Winding Machines \(A\)](#)  
[Motor Winding Machines \(B\)](#)  
[Motor Winding Machines \(C\)](#)  
[Motor Winding Machines \(D\)](#)  
[Multimeter Digital](#)

## N

[Network analyser](#)  
[Network analyser \(Top model\)](#)  
[NTSC T.V. Trainer](#)  
[Null - Voltmeter](#)

## O

[Optical fiber](#)  
[Oscilloscope 20MHz](#)  
[Oscilloscope 40MHz](#)  
[Oscilloscope 60 MHz](#)  
[Oscilloscope \(digital\) up to 500Ms/s](#)  
[Ovens for Electromechanics](#)

## P

[Panel Ammeters](#)  
[Panel Meters](#)  
[Paper Less Recorder \(panel type up to 6 channels\)](#)  
[Phase Shift Generator](#)  
[Phase Shifter](#)  
[Phase Sequence Indicator](#)  
[Power supply Unregulated](#)  
[Power supply for laboratory \(A\)](#)  
[Power supply for laboratory \(B\)](#)  
[Power supply \(weeled\)](#)  
[Pneumatic Learning Systems](#)  
[Power Factor Meter](#)  
[Printed Circuit Workshop](#)  
[Printed Circuit Board \(manufacture\)](#)  
[P.C.B. Machines](#)  
[Process Control](#)

## R

[Regulated Power supply \(A\)](#)  
[Regulated Power supply \(B\)](#)  
[Reed Frequencymeter](#)  
[Rheostat linear with 1, 2 & 3 elements](#)  
[Rheostat toroidal](#)  
[Refrigeration Learning Systems](#)  
[Resistance Decade Box](#)  
[Resistive Loads 0.1: 0.3:kVAr](#)  
[Resistive Loads 1-2kVAr](#)  
[Resistive Loads 3-5kVAr](#)  
[Resistor Box](#)  
[Robot \(A\)](#)  
[Robot \(B\)](#)  
[Robot \(Pneumatic Robot\)](#)

## S

[Sweep Function Generator](#)  
[Security Leads CE](#)  
[Security Terminals CE](#)  
[Security Terminals from 10 to 100A](#)  
[Shunt](#)  
[Single Phase Generators](#)  
[Single & Three-phase measuring System](#)  
[Servosystem \(Analogue\)](#)  
[Servosystem \(Digital\)](#)  
[Servo for a.c & d.c.](#)  
[Servo with pneumatic regulator](#)  
[Servosystem modular for DC & AC](#)  
[Slip Ring Motors 0.1 - 50kW](#)  
[Solder Iron & Solder Station](#)  
[Special Electric Machines](#)  
[Spectrum Analyzer](#)  
[Squirrel Cage Motors 0.1 - 50kW](#)  
[Stator Winding Machines](#)  
[Starter Rheostat 0.3-0.5kW](#)  
[Starter Rheostat 1kW](#)  
[Starter Rheostat 3kW](#)

## T

[Tacho-Generator](#)  
[Temperature controls](#)  
[Three Phase Generators](#)  
[Three Phase Network Analyser](#)  
[Telecommunications](#)  
[Telephony](#)  
[Temperature Process Control](#)  
[Temperature Process Simulator](#)  
[Terminals for Electronics](#)  
[Test leads CE](#)  
[Torque Meters](#)  
[Transformers 1PH & 3PH](#)  
[Transformateurs 1PH & 3PH](#)  
[Transmission Line Simulator](#)  
[Transducer Didactic Systems](#)  
[Three Phase Shifter](#)  
[Transfer Function Analyser](#)  
[Transformer winding Machines 2-5kVA](#)  
[Transformer Winding machines 0 - 2kVA](#)  
[Transducers](#)  
[T.V. Trainer](#)

## U

[Unregulated Power Supply](#)

## V

[Variable Autotransformers 1-PH & 3-PH](#)  
[Voltage AC Variators](#)  
[Variable Transformers High Power](#)  
[Voltmeter for D.C.](#)  
[Voltmeter \(Panel Type\)](#)  
[Voltmeters Electrodynamics](#)

## W

[Winding Machines](#)  
[Winding Machines \(manual\)](#)

<b>- <u>Products - Systems - Solutions</u> -</b>	
<a href="#"><u>Electrical Power &amp; Machines</u></a>	Modular systems of electric machines. Engines, generators, transformers, brakes, RLC loads, measuring instruments, power supplies ... <a href="#"><u>Electrical Machines Modular System 0,3kW EMMS 1kW EMMS 3kW</u></a>
<a href="#"><u>Electromechanics</u></a>	Motors and transformers mounting kit. Transformers and voltage regulators, winding machines, accessory ...
<a href="#"><u>Electricity/Electronics</u></a>	Analogue e digital systems, microprocessors trainink kit, PCB Software, transducers, power supply, benches, accessory ...
<a href="#"><u>Electrical Installations</u></a>	Training system for domestic and industrial installation, intercom systems, alarm systems and access control ...
<a href="#"><u>Laboratory Furnitures</u></a>	Benches for laboratory, electrification bars, cables, clips ...
<a href="#"><u>Telecommunications</u></a>	Analog and digital communications, modulation AM-FM, fibre optic, telephony, Lan, antennas, microwave ...
<a href="#"><u>Test &amp; Measurement</u></a>	Multimeters, analog and digital voltmeters, ammeters, wattmeters, frequency meters, oscilloscopes, logic analyzers ...
<a href="#"><u>Printed Circuits Boards</u></a>	Insulator machines, Etching machines, Oven for P.C.B, Special equipment and machines, Benches for PCB, Chemicals and accesories, Solders ...
<a href="#"><u>Robotics &amp; CNC</u></a>	Industrial robot, CNC lathe, CNC mill, CNC Simulation Sw ...
<a href="#"><u>Process Controls &amp; PLC</u></a>	Process control, Motor controls, digital control, position control, speed control, servo control, simulators & software, PLC ...
<a href="#"><u>ElectroPneumatic</u></a>	Pneumatics and electro pneumatic trainer, hydraulic trainer ...
<a href="#"><u>Industrial Machines</u></a>	Industrial Electric Machines, Mono & 3 Ph motors, Mono & 3 Ph Generators, Dc Machines, Ac Machines, Transformers, Power Supply ...
<a href="#"><u>Tools</u></a>	Electromechanic tools, measurement, welding ...

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